## REMARKS

The Office action mailed June 16, 2003 has been studied in detail along with the reference applied and cited by the Examiner. In response, the claims are presented without amendment for reconsideration in light of the following arguments in support of patentability. For the reasons set forth in greater detail below, the application is deemed to be in condition for allowance.

In the subject Office action, the Examiner rejected claims 1, 6 and 41 under 35 U.S.C. § 102(b) as being anticipated by U.S. Pat. No. 5,462,527 to Stevens-Wright ("the '527 patent"). The Examiner also rejected claims 2-5, 42-45, 48 and 49 under 35 U.S.C. § 103(a) as being obvious over the '527 patent.

Regarding the anticipation rejection, the Examiner indicated that the '527 patent discloses "a flexible spacer means 16." Applicant's claim 1 recites "spacer means disposed between said pair of flexible tension/compression members at said distal end for maintaining lateral spacing between said members, said spacer means being flexible." Applicant's claim 41 recites "a flexible spacer disposed between the first and second flexible tension/compression members at said distal end for maintaining lateral spacing between said members."

The flexible spacer means referred to by the Examiner in the '527 patent is denoted in the '527 patent as a tubular distal section 16 of the tip assembly 14. (Col. 3, lines 64-65). The tubular distal section 16 described in the '527 patent is not disposed between the pull cables 32a-32d, which the Examiner asserts to be flexible tension/compression members. To the contrary, the tubular distal section 16 of the tip assembly 14 receives the pull cables 32a-32d. (See col. 4, lines 20 -22 "The distal ends of the pull cables 32 are connected to various points of the tip assembly 14 as described below." and FIG. 3) Since the tubular distal section 16 of the '527 patent is not disposed between the pull cables 32a-32d, claims 1 and 41 fail to read upon the '527 patent. Therefore, the '527 patent does not anticipate either claim.

Furthermore, it would not have been obvious to modify the apparatus disclosed in the '527 patent such that claims 1 or 41 would read upon such a modified device. The '527 patent provides no motivation to modify the apparatus such that the tubular distal section 16 of the tip assembly 14 is disposed between the pull cables 32a-32d. The pull

cables 32a-32d can only be placed in tension, which will be discussed below. Since when one pull cable is placed in tension the other pull cable goes slack, the cables act indcpendently of one another. One skilled in the art would have no motivation to provide a spacer between two cables that act independently of one another.

With regards to claims 3 and 4, which further define the spacer means, and claim 43, which further defines the flexible spacer, the Examiner asserts that these claims are obvious in view of the '527 patent. The Examiner asserts that one of ordinary skill in the art would have seen the obviousness of utilizing any form of available spacer capable of providing the necessary separation between the tension/compression members. The Examiner bases the finding of obviousness on the basis that "the applicant gives no criticality, asserts no advantage, and cites no particular purpose for this feature, other than the fact that said element must maintain a transverse or lateral spacing between the tension/compression members." To establish a *prima facie* case of obviousness, the Examiner must provide some suggestion or motivation to modify the reference. When rejecting claims 3, 4 and 43, the Examiner has placed the burden on the applicant ("the applicant gives no criticality, asserts no advantage, and cites no particular purpose for this feature"). Shifting the burden to the applicant to provide advantages of the spacer means or flexible spacer is improper. Accordingly, the Examiner has failed to establish a prima facie of obviousness with regard to claims 3, 4 and 43.

Referring again to the anticipation rejection, the Examiner indicated that the '527 patent discloses flexible tension/compression members 32a-32d. When responding to the applicant's arguments made in the applicant's previous response, the Examiner further contends that "nothing in the '527 patent refers to one cable as being slack while the other is in tension." The applicant respectfully asserts that even though the '527 patent may not explicitly disclose that one cable goes slack while the other is in tension, the '527 patent inherently requires one cable to go slack while the other is in tension.

In the paragraph beginning at column 6, line 25 of the '527 patent, the patentee describes the pull cables 32a-32d. The patentee explains that "[t]he illustrated catheter provides for both proximal and distal bending by pulling selected ones of the pull cables 32a, b, c or d." The patentee explains that the "bending of the distal section 16 does not cause bending of proximal section 15 (or shaft 10) and vice versa." The patentee goes on to declare that "[t]o provide this result, it is **necessary** that the shaft 10 be stiffer than proximal section 15 and that the proximal section 15 be stiffer than the distal section 16." (Emphasis added).

The catheter described in the '527 patent has the proximal section 15, not the non-tensioned pull cable, carry any compressive load that results from placing one of the pull cables 32 in tension. (See FIG. 13a) If this was not the case, there would be no need to require the shaft 10 to be stiffer that the proximal section 15; the compressive load could simply be carried by the non-tensioned pull cable.

The patentee goes on to state that "[i]f independent proximal and distal bending is not desired, the difference in stiffness between the sections is not critical." What naturally follows from the preceding statement is that without having the shaft 10 of the catheter carry the compressive load that results when placing one of the pull cables in tension, the entire shaft 10 would bend, as opposed to only the distal end. Such would not be the case where the non-tensioned pull cable carries the compressive load. If the non-tensioned cable could carry the compressive load, the entire shaft would not have to bend. To the contrary, a more controlled bend of the distal end of the shaft would be allowed. In view of the above, the '527 patent may not explicitly state that one cable is slack while the other is in tension; however, when examining the reference as a whole, the '527 patent provides no inherent teaching of placing one pull cable in tension while placing one pull member in compression. Accordingly, the '527 patent only teaches or fairly suggests placing one pull cable in tension while having the shaft carry the compressive load.

The Examiner goes on to state that FIG. 13a of the '527 patent, which the applicant asserts discloses a pull cable going slack, "could equally as well be showing a cable that is buckling (i.e., a cable that is under compressive force.)" The Examiner then directs the applicant's attention to U.S. Pat. No. 5,944,690, ("the '690 patent") which according to the Examiner "explicitly states that mechanisms for steering catheters typically include control cables which are operated in such a manner so as to place one of the cables in tension, while ' ... simultaneously compressing, or buckling, the other wire." In the very next paragraph of the '690 patent, the patentee states "the repetitive tensioning and buckling of the control wires often causes premature control wire fatigue." In the next paragraph of the '690 patent, the patentee discusses means for absorbing the slack, or buckled portion of the non-tensioned wire. The '690 patent discloses exactly what the applicant argued in his previous response, in response to a first pull wire being placed in tension, the second pull wire goes slack. Generally, cables offer no resistance to compressive forces. (See attached pages from Engineering Mechanics: Statics, R.C. Hibbler, page 326 where it is explained that a cable offers no resistance to bending and therefore the tensile force acting on a cable is always

tangent to the cable at points along its length.) A compressive force would necessarily result in a bending force. That a mechanism is provided to place a compressive force on one of the pull wires is insignificant, the pull wire does not carry the compressive force. Additionally, the cables are referred to as pull cables at least fifty times throughout the detailed description of the '527 patent, which further bolsters the argument that the cables do not carry a compressive force. Additionally, the cables are described as being made of a multiplicity of ultra-high molecular weight polyethylene filaments, each forming a bundle with a diameter in the range of 0.003-0.004 inches. Such a construction is not likely to carry a compressive force, particularly when evaluated in light of the remainder of the '527 disclosure.

As way of example only, and not to be bound to only the description provided, the applicant directs the Examiner's attention to the first full paragraph on page 47 of the applicant's specification. Unlike known catheters, the applicant's catheter does not transmit the compression loading to the inner guide tube, as disclosed in the '527 patent. To the contrary, the compression loading is transmitted to one of the tension/compression ("referred to as push/pull members") that is not being tensioned. Accordingly, the applicant's claims patentably define over any fair inherent or explicit teaching attributable to the '527 patent.

All formal and informal matters having been addressed, this application is in condition for allowance. Early notice to that effect is solicited.

Respectfully submitted,

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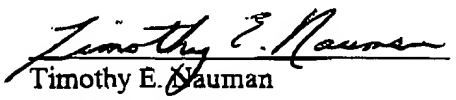

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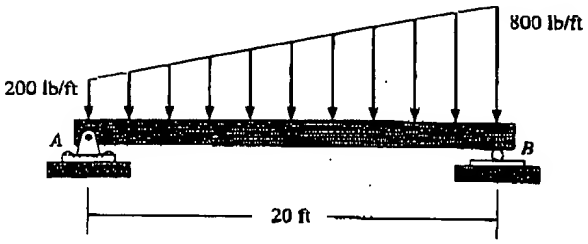
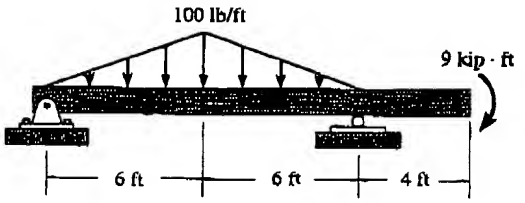
**7–74.** Draw the shear and moment diagrams for the beam.




**Prob. 7–74**

**7–75.** Draw the shear and moment diagrams for the beam.




**Prob. 7–75**

## *7.4 Cables



Flexible cables and chains are often used in engineering structures for support and to transmit loads from one member to another. When used to support suspension bridges and trolley wheels, cables form the main load-carrying element of the structure. In the force analysis of such systems, the weight of the cable itself may be neglected; however, when cables are used as transmission lines and guys for radio antennas and derricks, the cable weight may become important and must be included in the structural analysis. Three cases will be considered in the analysis that follows: (1) a cable subjected to concentrated loads; (2) a cable subjected to a distributed load; and (3) a cable subjected to its own weight. Regardless of which loading conditions are present, provided the loading is coplanar with the cable, the requirements for equilibrium are formulated in an identical manner.

When deriving the necessary relations between the force in the cable and its slope, we will make the assumption that the cable is *perfectly flexible* and *inextensible*. Due to its flexibility, the cable offers no resistance to bending, and therefore, the tensile force acting in the cable is always tangent to the cable at points along its length. Being inextensible, the cable has a constant length both before and after the load is applied. As a result, once the load is applied, the geometry of the cable remains fixed, and the cable or a segment of it can be treated as a rigid body.